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ions are normal in behavior, we are led at once to the principle of the constancy of the solubility product, the substantial correctness of which has been demonstrated by the experiments of Noyes, and the more recent work of Stieglitz. An entirely similar method which depended upon the elimination of the undissociated electrolyte was employed by Rothmund in his study of the dissociation of picric acid.

Another deduction which is similarly justified is that the product of the hydrogen and hydroxide ion concentrations is a constant, in any dilute aqueous solution, and this important constant has been obtained by several independent methods, all in excellent agreement. Finally the Nernst equation for the electromotive force of a concentration cell gives very satisfactory results when we consider only the ion concentrations. If, however, we apply an equation similarly obtained to the undissociated portion of the electrolyte we obtain results which are by no means corroborated by experiment.

A few years ago I had occasion to make a calculation which involved simultaneously the application of all the principles which I have just enumerated, the Nernst equation, the solubility product, the dissociation constant of water. By the aid of these it was possible to calculate from the decomposition pressure of silver oxide the potential of the oxygen electrode. The potential thus obtained differed more than one tenth of a volt from the value previously accepted, but was in perfect agreement with the results of the independent investigations published during the same year by Haber and by Nernst. The calculation would obviously have been vitiated if any one of the principles used had been unreliable.

To review the service rendered by these simple generalizations deduced from the ionic theory would be to summarize a very

considerable part of the exact work in physical chemistry published during the past two decades. In the study of chemical equilibrium and reaction velocity, especially in the process of rationalizing quantitative analysis, these principles are of daily service.

While therefore many difficult problems relating to the application of the ionic theory remain to be solved, this theory must even at the present time be regarded as established on a sound working basis. Advance will come through the exact quantitative study of the properties of aqueous, and especially of non-aqueous, solutions. After this work is completed it is not improbable that our views of the nature of solutions will be greatly changed, but I venture to predict that the later and better theories will not be substitutes for, but rather developments of, the simple hypothesis of Arrhenius.

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*THE COLLEGES OF THE UNITED STATES
AND THE CAMPAIGN AGAINST
TUBERCULOSIS*¹

THE colleges and universities of the United States are social forces of such power that the campaign against tuberculosis can not ignore them: it needs their help, it seeks to enlist them among its strongest allies. And the campaign is so reasonable, so timely, and already so efficient, that it may confidently expect the cooperation of the colleges of the country, as, indeed, it depends on the cooperation of all intelligent men and women interested in the betterment of man.

First in importance among the aids which the higher schools are giving is perhaps the investigation of fundamental

¹Read before the International Congress on Tuberculosis, Washington, D. C.

problems. It is largely in the universities that the problems which come under the cognizance of this section of the congress—problems of hygiene and sanitation, of economics and sociology—are being solved, and it is here that students of the subject are trained in special methods of research. As examples of various lines of investigation carried on in the higher schools, I may mention the advanced courses in social economics under Dr. E. T. Devine, at Columbia University, where in 1908 an entire term was devoted to seminar work on the social aspects and control of this disease; the investigations of Professors Fisher, Baily and Farnham, of Yale, in diet and housing in sanatoria, and in the relation of tuberculosis to labor and tenement conditions; the sociological work at the University of Chicago where students accompany patients of the college dispensary to their homes, together with the regular visiting nurses and physicians and study local conditions and surroundings and the methods employed in improving the environment; and the work of the University of Wisconsin whose classes from the departments of political economy and sociology visit Milwaukee to study the social and industrial aspects of the disease. In not a few colleges students are securing valuable data as to some of the simpler problems of the local fields of the college or of their home towns and counties, such as the number and proportion of deaths from tuberculosis, the recurrence of the disease in infected houses, the average length of the disease, and its economic losses. From answers to a questionnaire sent to two hundred representative higher schools of the United States, it is found that about one fifth are engaged in investigative work in tuberculosis.

The higher schools are also furnishing from their faculties not a few men of

knowledge and conviction as leaders in the propaganda. The lists of officers of this congress, of the National Association and of the state leagues and state boards of health show that the colleges are supplying at least their full quota for this purpose.

A most effective help which the colleges are giving in the fight is along educational lines. In states where the commonwealth does not furnish lecturers for the educational campaign, the work of arousing and teaching the people from the platform falls largely on the schools. University extension courses, summer chautauquas and more incidental occasions furnish a means of reaching the people which Phillips and Garrison might have coveted in their campaign against slavery. The subject of public health receives an interested hearing everywhere, and on this theme the college man speaks with an authority and influence enhanced by his institutional relations. And to college men the educational campaign makes a specially strong appeal. We can not see the people perish for want of knowledge, knowledge which it happens to be our good fortune to possess, and not be stirred by some missionary zeal to go forth and preach the gospel of sanitation and the salvation which it offers from disease. University extension lectures on tuberculosis are now offered by at least fifteen colleges and universities.

A still more fruitful field lies within the college walls. In our students we find an exceptional receptivity to new truth. The stolidity of ignorance, unable to apprehend fundamental principles, the inertia of long-fixed habits of thought and will, the prejudice of financial interests imperiled—none of these obstacles are present in the college. Surely that warm-hearted enthusiasm of youth, easily stirred to noble ends, which in our civil war sent forth to battle the boys of the colleges of North and South

alike, may be aroused to serve in a campaign whose purpose is not to destroy life but to save it.

Some of our colleges are teaching by example the prophylaxis of the disease in the way of bacterial cleanliness. At Dartmouth the class rooms, dormitories and chapel are examined every two weeks by the exposure of gelatine plates, and when the number of bacteria which fall on these plates during ten minutes exceeds forty, the rooms are thoroughly disinfected with formaldehyde. Since the adoption of the wholesale method of disinfection the sickness among the students has been very markedly reduced, especially those mild forms of disease such as pharyngitis, tonsillitis, measles and ordinary colds. In a number of schools immediate attention is given to any suspicious cases of incipient tuberculosis. Colleges whose class rooms are well ventilated, which occasionally test them for the proportion of carbon dioxide present, teach the value of fresh air in the most emphatic way. And the schools whose aim is not the making of a few overspecialized athletes, but rather the physical well being, the maximum efficiency of all their students, inspire an ideal of vigorous health which translated into life becomes the best possible prophylaxis against tuberculosis.

As a matter of education, as well as for stronger reasons, a number of colleges have prohibited the rooming of students in families afflicted with tuberculosis and in houses where the occurrence of such cases has not been followed with disinfection. Where there are state or municipal regulations requiring registration and supervision of cases and prompt disinfection of houses after death or removal, and where these rules are rigidly enforced, there may be little need of college rules. But the replies to our questionnaire indicate that

such municipal or state regulations obtain in less than half of college towns and in a still smaller number are they effectively enforced. Apparently in the majority of our higher schools no control is exercised on this vital matter. The young student comes to the college town a stranger, utterly ignorant of the sanitary conditions of the houses of the town among which he is to choose his home. Very possibly he is ignorant of the causes of tuberculosis and sees no danger in joining a family infected with it. He is thus allowed to place his life in hazard without even a remonstrance from those who are supposed to have his physical well being in their charge and who with no great difficulty can usually know of the special places which form the ambushes of the disease. The reason why such regulations are not more widely made is in part the general exemption of college students from serious diseases. But before this reason is held sufficient, an examination should be made into the mortality from tuberculosis of the younger alumni, a mortality which is often high, and which in some instances may possibly be found significant of conditions in the environment of the college. The following from a correspondent in one of the large universities of the middle west may represent the attitude of many schools:

I believe that there are no faculty regulations at the present time, but the committee on hygiene has considered the matter and expects to inaugurate an active campaign in regard to this with the next school year. There has been so little trouble of this sort among university students that the need has not seemed urgent heretofore, but as matter of education I am personally very strongly in favor of it.

Among the matters which make for the education of the student as to tuberculosis is the use of the tuberculin test with the dairy cattle kept by agricultural colleges and by a number of schools for the use of

their boarding halls. The regular inspection of such dairy herds, reported by a number of colleges, is a duty so obvious that its neglect will go far to neutralize the most efficient teaching of the class room.

Our colleges are using the directest means of enlisting their students in the war against the great white plague. Local anti-tuberculosis societies are organized, as at Radcliffe. Special lectures or courses of lectures are given before student assemblies. At the Rose Polytechnic and at Bryn Mawr such addresses are given by the president. At Vanderbilt University the director of a tuberculosis exhibition held at Nashville was obtained to address the students. At Cornell College, Iowa, the Science Club for four successive years has provided open evening lectures for students and townspeople, securing for this purpose the state bacteriologist, the state lecturer on tuberculosis and one of the government meat inspectors from one of the cities of the state as well as physicians and teachers of the town and college. In about one fifth of the 200 representative colleges such lectures are now given before student assemblies.

A still larger number of schools give special attention to tuberculosis in the class room. At Dartmouth the physical director gives two or three lectures a year to the freshman class in a course on hygiene. Indiana State University provides instruction on tuberculosis, its causes, results and methods of prevention and cure, in a course of lectures on hygiene given by different members of the faculty and required of all candidates for graduation in the college of liberal arts. Purdue University assigns a large place to the subject in a series of lectures on health and efficiency and Carlton College provides for the same in a course on social problems. The propaganda is carried on in many schools in the departments of biology and hygiene, in sociology,

domestic science, sanitary engineering, and economics. The University of Wisconsin for several years has given lectures on tuberculosis in farmers' courses and before various meetings of teachers. The University of Minnesota makes such lectures an integral part in the program of its college of education.

The recent organization of schools of education in the stronger colleges and universities opens a large field for the propaganda. Colleges and universities now supply the majority of high-school teachers. To teach the students of the schools of education in the colleges and universities the facts as to tuberculosis is to disseminate these facts throughout the secondary schools. To enlist college and university men and women in the great crusade is to draw under the same banner the hundreds of thousands of high-school boys and girls who in the immediate years are to be under their instruction.

An educational agency effectively employed in some schools is the circular. The students of the University of Minnesota were recently thoroughly circularized on the subject under the auspices of the anti-tuberculosis committee of the Associated Charities of Minneapolis. At Syracuse University the students have entered so heartily into the campaign that they recently distributed cardboard circulars on tuberculosis printed in five languages to the 25,000 homes of the city.

Perhaps less than one half of our higher schools have as yet actively interested themselves in the twentieth century crusade. Yet even those replies to our questionnaire which confess a total lack of co-operation in the present are often most encouraging in their promise for the future. "It is high time that we devoted some attention to a matter of such vital importance," writes the president of a col-

lege of the middle west. And this from a president of one of the state universities:

I have to say in humiliation that practically nothing has yet been done in this state and in our institution as to tuberculosis. . . . I am going to take up the matter in the university next year. I regard the movement as one of supreme importance and hope to bear my share in the beneficent cause.

What results may we expect from the cooperation of all the colleges when it is once secured? Each year we shall enlist hundreds of thousands of the best young men and women of the country. We shall obtain through them the cooperation of the secondary schools whose teachers they supply. And as our students go out into every city and town and village in the land to take their places as citizens of exceptional influence in their communities, we shall secure the cooperation of the leaders of the future. The harvest sown in the college may be some years in ripening, but it is no less sure.

In summation let me say that we may reasonably ask the college and university to help us by giving instruction on tuberculosis in general lectures before student assemblies and in specific teaching in the class rooms of the social, economic and biological sciences. We may ask for exemplary sanitation of college buildings, for inspection of college herds, and for care over the health of students by regulations securing immunity from house infection and by the early detection of incipient cases of the disease. We may ask for the exertion of effective influence in securing model sanitary conditions in the immediate college environment and for help in promoting the propaganda throughout the state and nation in every possible way.

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PROPOSED PUBLICATION OF EULER'S WORKS

STRENUOUS efforts are now being made to secure the publication of the complete works of Leonhard Euler (1707-83), one of the most prolific writers of all times on pure and applied mathematics. Euler lived at a time when the differential and integral calculus was still young, and he was most influential in making this powerful instrument of thought more easily available in the various fields of mathematics. The enormous extent of his writings has been a great obstacle in the way of securing a publication of his complete works and has thwarted earlier efforts along this line. From a recent circular issued by the Swiss Society of Natural Sciences, it appears that we may reasonably expect that the publication of this great work will begin at an early date. The following extract from this circular should be of interest:

On the initiative of the German Association of Mathematicians, the International Mathematical Congress, meeting at Rome in April, 1908, unanimously passed the following resolution:

"The fourth International Congress of Mathematicians, held in Rome, regards the publication of the whole collection of Euler's works as an undertaking of the greatest importance, both to pure and to applied mathematics. The congress gratefully welcomes the initiative taken by the Swiss Society of Natural Sciences in this matter and expresses the wish that the great work may be carried out by that society in common with the mathematicians of the other nations. The congress begs the International Association of Academies, and more particularly the Berlin and St. Petersburg academies, of which Euler was so preeminent a member, to support the enterprise in question."

Immediately on the adoption of this resolution the representative of the Paris Academy, Mons. G. Darboux, made known that the International Association of Academies had discussed the Euler question at Vienna in the preceding year, and had expressed entire sympathy with the movement. The correspondence which has since taken place between the president of the Swiss Euler Committee and Mons. Darboux, as also with Herr Lindemann, who had aroused interest in the matter in Vienna, leads us to hope that the support of the Association of Academies will be